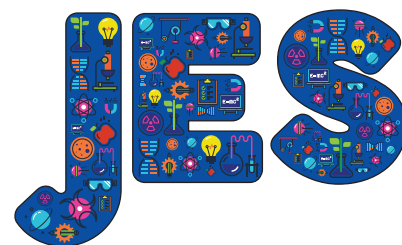


A science 'show and do': Teacher and technician training – down under



● Magdalena Wajrak ● Nardia Bordas ● Tim Harrison

Abstract

Science demonstrations and experiments play an important role in the teaching and learning process. This creates a challenge for some teachers whose own training may not have involved the skills and confidence to deliver some of these activities. University science departments, in liaison with local primary and secondary school teachers, can provide meaningful practical science professional development in this area. The opportunity for teachers and technicians to spend several hours engaged in hands-on practical work alongside academics and, as importantly, their peers, has been welcomed in Western Australia (WA) for several years. After initial courses in chemistry practical work, the sessions have, by request, expanded into the other sciences, including Aboriginal science.

Keywords: University-school liaison, teacher workshops, professional development

Introduction

The School of Science at Edith Cowan University (ECU) in Perth, Western Australia, has been working with Bristol ChemLabS Outreach (School of Chemistry, University of Bristol, UK) to deliver professional development (PD) to local educators since 2010, over a week-long period each year. Several half-day teacher and technician sessions were created and delivered. The half-day workshops have been well received. Subsequent national initiatives make such events even more in demand.

The rationale behind the professional development project

Chemical demonstrations and experiments play an important role in the teaching process, delivering a visual representation of difficult concepts and attraction to the fun of chemistry. (Bodner, 2001;

Lister, 1996). There is evidence to suggest that students recall the visual imageries of a demonstration and/or experiment long after the words have been forgotten (Bodner, 2001; Garcia-Martinez & Serrano-Torregrosa, 2015). Both offer a foundation by which learning can be built upon and thus facilitate the retention of such knowledge (Bodner, 2001; Garcia-Martinez & Serrano-Torregrosa, 2015).

Student participation in STEM subjects in primary and secondary schools has become a key focus of the Australian Government (Department of Education and Training, 2015). Stimulating students to study STEM subjects and exposing them to scientific careers will likewise help to secure Australia's future (Department of Education and Training, 2015; The Australian Industry Group, 2015). Beginning interest in the school sector will increase the number of individuals taking on STEM subjects in tertiary education and in their careers (The Australian Industry Group, 2015). This echoes a Europe-wide concern about school students, the future of Europe and STEM (Rocard, 2007).

A focus for primary school science was announced in August 2017 by the Premier of Western Australia, Mark McGowan, so that primary schools can help to prepare students for future employment opportunities in STEM (McGowan, 2017). The McGowan Government committed AU\$12 million to turn classrooms into laboratories, providing teachers with the appropriate facilities, glassware and equipment to operate chemistry experiments. The project evolution is summarised in Figure 1 overleaf.

Contents of the PD workshop

The initial focus of the project in 2010 was chemistry. The content of the chemistry workshop remains relatively unchanged. It consists of two



Figure 1: Evolution of the workshops.

Project Evolution

2010 – pilot workshops solely for laboratory technicians (chemistry focus)

2014 and 2015 – extended invitation to high school chemistry teachers

2016 – content from other sciences added

2017 – sessions now open to all primary (using some resources from the Primary Science Teaching Trust; Shallcross *et al*, 2015) and high school science teachers and science technicians

main areas: the first is a series of practicals that are a little unusual to many science teachers, such as the use of thermochromic paints, 'polymorph' thermoplastic, burning methane bubbles off a hand and producing iron on the head of a match. Many of these can be found in the Royal Society of Chemistry's (RSC) resource *Classic Chemistry Demonstrations* (Lister, 1996). The second area includes the types of experiments that cannot usually be done in a school, such as those with liquid nitrogen and dry ice. Such experiments are always useful for science teachers to be able to tell their students that they have done, or even to record the experiments on their mobile devices as they do them to add into their resources. Other areas include rocketry, Aboriginal science and microbiology.

The 'show and do' (or show and play) workshop consists of a presenter going through each activity, explaining the science behind it and how to demonstrate this most effectively. In practice, the group is split into two, visit one set of presenters, then have a go themselves before moving to the second group of presenters. Participants observe presenters' demonstrations for about 1-1.5 hours and then get time to 'play', 'discover' and 'network' for 1.5-2 hours. A combined lunch is provided between the morning and afternoon slots to allow participants from both sessions to network.

Feedback from previous workshops

Feedback is vital for the ongoing development of the workshop. Each year participants complete a

questionnaire and feedback is implemented in subsequent workshops where considered practicable or desirable. The relative novelty of a 'show and do/play' workshop has been obvious from observations during the sessions and from comments received (a sample of typical comments is provided in Figure 2):

Meeting expectations is a tricky thing to plan for a large group of delegates coming from a range of school types, job roles and those who re-attend these courses. We know that, for those who said no, it didn't mean that the main reasons were that they did not receive lesson plans; this was something we worked with teachers on developing using these experiments, but did not provide them ready-made because we wanted to support the teacher's development. One way of gauging the success of a workshop is the intent to revisit or to suggest to colleagues that they should attend.

Feedback from 2017 workshop

This year there were 37 participants from both primary and high schools in the two workshops.

Overall Comments:

'Fantastic! Informative, entertaining and very useful for my teaching.... which PD usually isn't'

'This was a fantastic PD and I really appreciated the opportunity to attend'

'I would highly recommend it to other teachers'

'Seeing the experiments and having a chance to also "play"'

'An absolutely brilliant workshop, I was really inspired'

	Yes	No
Attended similar before	31%	69%
Met your expectations	90%	10%
Interested in attending again	100%	0%
Would your school have funding for you to attend again?	85%	15%

Figure 2: Feedback examples from the 2017 workshops.



We know that, in a few instances, people wanted to return because there was not enough time to work through all that is available. We do not expect people to work through everything, as we are catering for such a wide range of educators. However, all the attendees wanted to either attend again and/or recommend the workshop to a colleague.

The PD events delivered since 2010 have been free of charge to course participants. An important factor for future planning is whether future

courses will be 'pay-to-play'. Charging for events such as these is a tricky internal matter for schools and colleges.

Suggestions for improvement

Where possible, suggestions received have been implemented. However, as with all such events, some suggestions cannot be acted upon for a host of reasons (see Table 2) that are not considered by participants.

Suggested improvement	Comment by organisers
Longer sessions	Initially the sessions were 2 hours long and each year we have added another 0.5 hour. Last year, the workshop ran for 3 hours. Since two workshops are run in one day, there is a maximum limit of 3 hours per workshop.
Link each activity to the curriculum	The resource booklet has partly done this – but it is sad that a narrow curriculum view is present. That said, the booklet is being re-written, with each experiment and demo being linked to the WA curriculum. The booklet will be ready by the end of 2018 and it is hoped that it will be adopted by WA schools to be used as a teaching tool in chemistry topics.
More structure	The structure of a 'show and do/play' event does not lend itself to a highly structured event. Some educators may not be comfortable with this.
More safety and disposal information	The resource booklet addresses this but cannot supersede local rules.
More technician input	The resource booklet addresses this, and several technicians, including a university technician, were on hand for comment and help.
More equipment sets to allow more repeats of each activity	Two teaching laboratories were set up. It is always a compromise to have a large number of experiments rather than a smaller number with more kits for repeats.

Table 2: Suggested improvements and limitations considered by organisers.



Requests for additional topics included: plastics, forensics, fuel cells and sensors. These are under consideration. There is a demonstrated appetite for training courses for educators in the Greater Perth area. Suggestions were also given for other courses, which delegates hoped that ECU could provide in the future:

- ❑ Understanding the underlying chemistry
- ❑ Chemical handling and disposal
- ❑ Science communication
- ❑ Analytical chemistry instruments
- ❑ Extension activities
- ❑ Science week visits
- ❑ Trainee teachers and technicians
- ❑ Safety courses
- ❑ ICT training

An initial request for resources has resulted in the activities booklet (Wajrak & Harrison, 2014) being written and distributed at these and other PD events.

Summary

The professional development (PD) workshop organised by ECU with Bristol ChemLabS (Shallcross *et al*, 2013) input has now been attended by over 300 primary and high school lab technicians and teachers and is now a permanent fixture in the ECU Outreach Science programme, and in technician and teacher organisations' timetables. The workshop is so popular that bookings are made in June for the annual November workshops. Recent Australian government announcements as to the importance of STEM in primary and secondary schools suggest that these PD sessions will be required for many more years.

Anyone who wishes to obtain a copy of the resource booklet can do so by contacting Dr. Magda Wajrak at: m.wajrak@ecu.edu.au

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Dr. Magdalena Wajrak, Chemistry Lecturer, and **Nardia Bordas**, Laboratory Technician, at Edith Cowan University, Western Australia. E-mails: m.wajrak@ecu.edu.au and n.bordas@ecu.edu.au

Tim Harrison FRSC CChem, School of Chemistry, University of Bristol, UK
E-mail: t.g.harrison@bristol.ac.uk

